FINAL REPORT

Review of Wisconsin Bypass Road Design Practices

February 13-14, 2006

Safety and Design National Technical Service Team

201 Mission Street Suite 2100 San Francisco, CA 94105	61 Forsyth Street, SW Suite 17T26 Atlanta, GA 30303-3104	19900 Governors Drive Suite 301 Olympia Fields, IL 60461	10 S. Howard Street Suite 4000 Baltimore, MD 21201-2819

EXECUTIVE SUMMARY
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FHWA Resource Center, Safety and Design Team
February 13-14, 2006

The Federal Highway Administration (FHWA) Resource Center Safety and Design Team was invited to perform a road safety audit/review of design practices on Wisconsin bypass roads. The request emanated from a higher than expected number of crashes and fatalities on various new facilities in the last year. The primary goal was to review design and operational practices on several existing bypasses in Wisconsin in order to assist the State in assuring that they have the best and safest roads that they could upon opening and for the longer term for all bypasses in Wisconsin.

A team of four specialists from the Resource Center joined the FHWA Division Safety Engineer on February 13 to perform the review. The Bypass Review Team visited the following bypass highway sections in the course of the review: Fort Atkinson Bypass (STH 26), Fond du Lac Bypass (US 151), Whitewater Bypass (US 12) and Oconomowoc Bypass (STH 67/STH 16). Using Road Safety Audit principles, the team reviewed the bypasses multiple times from end to end with numerous stops at interchanges and intersections. Driving, walking and stationary observations were made from differing angles and approaches. At various locations, the team reviewed specific features and compared them to the best practices for geometric design, traffic control, human factors, and driver expectations.

The team arrived at several conclusions that are universally applicable to 4-lane expressways and bypasses in Wisconsin. Specifically, three items of a global nature were identified and are described in the report. The team recommends that these global conclusions be considered by WisDOT as they continue to develop and improve the intersection elements of their strategic highway safety plan.

1. **WisDOT should look at the potential of going beyond nominal design and operational practices on their bypasses.**

2. **WisDOT should strive for consistency in design and operation of bypasses – locally across a project and across the state – to ensure a more uniform and consistent driver expectation.**

3. **Considering the two issues above, the team strongly recommends the application of design review concept of Road Safety Audits for future bypass and expressway projects. (See Appendix C for further description of Road Safety Audits.)**

Using detailed site information as a basis, the report identifies several best practices that WisDOT could use on their roadways to support the achievement of the global recommendations. The application of the best practices described in the report offer the greatest promise for Wisconsin. The report also provides recommendations on targeted training throughout the department and for better managing speed and intersection violations on the bypasses. All of the recommendations stem from the view that the Wisconsin bypasses are and should be viewed as unique roads requiring unique attention to their design criteria for safety. Ultimately, the team believes that Wisconsin can effectively develop bypass roads that serve important mobility and safety needs. With regard to the report findings, the FHWA is prepared to schedule briefings on topics in this report for the senior management of WisDOT or provide other training and support follow-up as needed.

REPORT
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Background
The Federal Highway Administration (FHWA) Resource Center Safety and Design Team was invited to perform a road safety audit/review of design practices on Wisconsin bypass roads. The request emanated from a higher than expected number of crashes and fatalities on various new facilities in the last year. In particular, Wisconsin Department of Transportation (WisDOT) was very interested in learning if they could improve their practices in order to minimize or eliminate crashes on 4-lane expressways in the future.

The primary goal was to review design and operational practices on several existing bypasses in Wisconsin in order to assist the State in assuring that they have the best and safest roads that they could upon opening and for the longer term for all bypasses and expressways in Wisconsin.

The Review
A team of four specialists from the Resource Center joined the FHWA Division Safety and Design Engineer on February 13 to perform the independent field review. The Resource Center Team members brought diverse design, traffic engineering, human factors and law enforcement experience at the Federal, State and local levels. This experience was rounded out with broad national exposure to design and safety practices across the United States. The team members were:

Patrick Hasson, National Technical Service Team Leader, Safety and Design
Fred Ranck, Safety and Design Engineer
Craig Allred, Transportation Safety Specialist
Peter Rusch, Safety Engineer
William Bremer, Safety and Design Engineer

The goal of the Bypass Review was to investigate crash locations as related to intersections and interchanges and then meet with State DOT officials the following morning to provide preliminary conclusions and recommendations. For some bypasses, the team reviewed various documents such as crash reports, crash listings, and speed studies prior to conducting the on-site Bypass Review. They also reviewed a report prepared in September 2005 by WISDOT on the Whitewater Bypass. The earlier report is attached as Appendix E in the current report.

The team visited the following bypass highway sections in the course of the review:

- Fort Atkinson Bypass (STH 26),
- Fond du Lac Bypass (US 151),
- Whitewater Bypass (US 12) and
- Oconomowoc Bypass (STH 67/STH 16).

Using Road Safety Audits (RSA) principles, the Bypass Review Team reviewed each of the bypasses. The team reviewed the bypasses multiple times from end to end with numerous stops at interchanges and intersections. The team also viewed the interfaces beyond the project to improve their understanding of the overall transportation routes. Driving, walking and stationary observations were made from differing angles and approaches. Numerous photographs were taken to gain different perspectives at the different sites. At various locations, the team reviewed

specific features and compared them to the best practices for geometric design, traffic control, human factors, and driver expectations. Taking account of the background materials described above, the team then analyzed the effects of these specific features to identify suggestions for making the roadways even safer.

Global Conclusions

After reviewing all of the bypasses, the team arrived at several conclusions that are universally applicable to 4-lane expressways and bypasses in Wisconsin. Many of the conclusions also apply to new 2-lane rural highways. Among these, the team felt that overall the State has good design practices. In fact, in many instances the state should be commended for exceptional design practice. However, the Bypass Review Team concluded that several design and traffic control areas showed potential for improvement. Specifically, three items of a global nature were identified and are described below. The team recommends that these global conclusions be considered by WisDOT as they continue to develop and improve the intersection elements of their strategic highway safety plan.

1. **WisDOT should look at the potential of going beyond nominal design and operational practices on their bypasses.**

   "Nominal" or "Minimal" geometric design can have serious negative safety performance results. It is not enough to just satisfy the bare minimum values for geometric and pavement design; Wisconsin should go beyond nominal design on their expressways and bypasses. Simply put, the team concluded that the bypasses being constructed in Wisconsin, whether 2-lane or multilane divided expressways, are not just another conventional roadway and in fact, are unique roads for the state that require more attention compared to other rural roadways. It is worthy to note that WISDOT already goes beyond nominal design in some ways on most if not all of their bypass roads. The team believed, however, that more routine application of some current practices that go beyond the nominal could make a difference in the safety performance of bypass highways. Based upon the on-site Bypass Review, the team believed that addition of a few key treatments with known safety benefits of the existing designs would make a difference in reducing severe crashes.

   Bypasses are unique highways and are likely to experience more crashes than expected when designed and operated nominally due to the following human factors analogy. Prior to building a bypass of a community, drivers leaving a community on a highway gradually increases speed until reaching a rural environment where they can reach highway speeds of 55mph at their own pace. Typically, the speed limit is 25mph in the urban area, then 35, 40 or 45 mph in transition areas and finally 55mph when reaching a rural environment. Drivers are thus in a high speed mind set when they reach the rural area and subsequent intersections. When a rural 55 mph bypass is built around a community, highway approaches from the community are typically still in the transition speed limit area when they intersect the bypass. Drivers leaving the community have typically been at a speed of 45mph or less when they reach the bypass. They are not as mentally prepared then for the higher speed traffic on the bypass, as if they had been driving for some time at rural highway speeds. This seems to be borne out by the fact that typically, most angle crashes at the bypass intersections involve a vehicle that was traveling outbound from the community and the driver is a resident of the community.

   Wisconsin should strive for consistency in design – locally across a project and across the state. The team found a wide variation of design applications both within individual projects

and across the projects. This is not to say everything was inconsistent. A couple of the bypasses exhibited high degrees of consistency. However, others had major variation.

2. **WisDOT should strive for consistency in design and operation of bypasses– locally across a project and across the state – to ensure a more uniform and consistent driver expectation.**

   The team found a wide variation of design and operational applications both within individual bypass projects and across the projects. In other cases the bypasses exhibited high degrees of consistency. Some of these differences may be explained by the experience and expertise of the designers themselves related to bypass design and operation whether in-house or by a consultant. There is also not likely a coordinated effort from Region to Region on bypass design and to some extent, within a Region between various designers or design teams. When the DOT has adopted bypass design and operation practices, based on the recommendations from this FHWA report as a starting point, those practices should be included in a new specific section of the Wisconsin Facilities Development Manual and the Traffic Guidelines Manual on highway bypass design and operation. In addition, all design staff including consultants and operations staff should be trained in the best practices for bypasses adopted by the Department. It should also be noted that the mere fact that a new highway has been opened presents challenges for first time users, particularly at the intersections on the bypass. Consistency across projects can help allay some of the challenges presented by this situation.

   In addition, there is a significant amount of turning traffic leaving and entering the community at the bypass intersections which can compromise visibility of vehicles on the bypass for the entering or leaving traffic. These traffic conditions also call for designing and operating the bypass intersections above nominal. A key issue that was raised in the course of the Bypass review concerned the use of at-grade intersections versus the construction of interchanges, especially where traffic volumes do not necessarily dictate the need for an interchange. Normally, one would expect interchanges are provided for state trunk highway and high volume county trunk highways. In this light the team concluded that intersections may be appropriate if volumes do not justify an interchange. However, the design needs to be well done and consistent across locations. If an interchange is the eventual desire at a location in 20 or more years, the “interim” at-grade intersection that will be in place until that time must have high quality geometric and traffic control design to ensure the greatest safety performance.

3. **Considering the two issues above, the team strongly recommends the application of design review concept of Road Safety Audits for future bypass and expressway projects.**

   Appendix C provides a short description of Road Safety Audits. The team believes that the application of RSAs will result in a balanced outcome reducing costs while increasing safety as well as provide a mechanism for the DOT to consistently apply good design and operational practices. The FHWA is ready to assist the State with training or other support as needed to act on this recommendation. Readers should note that the WisDOT report included in Appendix E is very similar to a product that would result from the conduct of an RSA, though normally an RSA is performed prior to construction of a highway, such as at the 30 percent design stage.

Overarching Considerations with Regard to Bypasses and Expressways

The decision to consider and build a highway bypass of a community is typically based on several factors. These may include the economic status of the community and other values of importance

to the community. Often more importantly however, it is also the operation and safety performance of the existing marked highway(s) through the community that is a deciding factor. The bypass is intended to reduce traffic flow and improve highway safety within the community. In the rural highway environment the very level of available resources and the design and operational practices for highways creates a hierarchy of expectation of their safety performance by road users. Clearly, Interstate highways have the highest level, then US and State Highways, then County Highways and then Town Roads.

Understanding this rural highway class safety expectation is important for the overarching decisions regarding bypass design and operation. If it is determined that the bypass will have interchanges or highway overpasses and at-grade intersections, any Interstate Highway junctions would be an interchange; a US or State Highway junction should be an interchange, a County Highway and Town Road/City Street junction would typically be an at-grade intersection or in some cases an overpass. Complete control of access along a new bypass is often directly related to the overall future highway class of the bypass, being a segment of a longer ultimate freeway for example.

Planning and designing a new bypass should therefore not only consider how access will be handled at the time of opening but also take account of a vision that will allow the bypass to function safely and efficiently for 20 years and beyond. For example, planners and designers should ask questions such as: Will the intersections go from stop control, to signal control and nothing more? Will the intersections be eventually upgraded to interchanges? Recognizing that funding for the bypass also plays a key role in the decision for the ultimate design and operation, how does the longer term design vision affect planning and decision making in the current design? This general information serves as a useful backdrop when considering the best practices that are described in the next section.

Suggested Best Practices

As mentioned earlier in this report, the team reviewed and inspected four different bypasses and intersections on each bypass. Site by site information is provided in Appendix A. Using this detailed site information as a basis, the team identified several best practices that WisDOT could use on their roadways to support the achievement of the global recommendations. The application of the best practices described in this section offer the greatest promise for Wisconsin. Appendix B provides a comprehensive listing of good practices that could be used on Wisconsin bypass roads. It is suggested that as WisDOT begins to evaluate their practices and standards that the entire list be considered in the process so that state engineers with more intimate knowledge of the environment can make the best choices for the state.

The sections below describe best practices that the review team believes can make the most difference for Wisconsin.

- Enhancing the Traffic Control - Signing
  Given that the bypass roads are fairly unique roads in the state, the team felt it was important for the state to make information for drivers approaching and at an intersection stand out. One way to do this is to provide advance warning signs, supplementary plaques for regulatory signs and to use a size above the minimum size for other conventional highways. The larger signs are more conspicuous and critically communicate to the drivers that they are on or approaching a higher class of roadway. In addition, in the larger environment of the expressway, larger signs stand a better chance of being detected and the information appropriately used than would standard size signs. Finally, some signs when larger provide a stronger position to compel drivers to comply with the information provided. For example,

using 30” x 36” or larger speed limit signs can make the work of police officers much easier when they can justifiably claim that everything that can be done to communicate the speed limits to drivers has been done prior to aggressive enforcement. Larger signs were noted on some but not all bypass roads. On the Whitewater Bypass, for example, smaller signs are used at the minimum size. It is interesting to note that, perhaps not coincidentally, there is a speeding problem on this bypass.

- Visibility of Right of way controls and positioning of vehicles on side road approaches to the bypasses – Application of “Pork Chop” Islands
  Pork chop islands are distinctively shaped islands that are placed in the near right position of a minor road at its intersections with a major road. Figure 1 illustrates a pork chop island. Pork chop islands provide several safety benefits. First, they provide the drivers on a lower speed approach with a significant visual cue that they are approaching and intersection with a higher speed road. Second, they provide a location more central to the driver’s line of sight approaching the intersection; the safety effect of this treatment has been quantified as overall 11 percent reduction in crashes. In particular for stop signs, they minimize the risk of a driver missing this critical right of control sign. In other words, the application of “pork chop” islands to a two-way stop controlled expressway intersection reduces error on the part of drivers by enhancing the visibility of the stop sign to the approaching driver. Second, the sign placement on the pork chop island assists the driver in achieving a better stop position such as to maximize the field of view of approaching conflicting traffic and to maximize their appearance for drivers on the higher speed facilities. The team found some instances of the application of “pork chop” islands in limited situations on the bypasses. It is the conclusion of the Bypass Review team that this application could be applied in a uniform manner to at-grade intersections on Wisconsin bypasses.

Figure 1: Illustration of how an island can be used to place an additional stop sign at an intersection.

- Left Turn Lanes – Part 1
  Left turn lanes in the middle of the highway have a strong proven safety benefit at intersections, whether they are signalized or unsignalized. Left turn lanes should be a standard at all intersections on bypass roads. Left turn lanes are not “bypass lanes” installed to the right of the through lane at an intersection; rather left turn lanes are positioned to the

left of the high speed through traffic lane. See Figure 2 below. Positive offset left turn lanes are even better for a safety benefit.

- Left Turn Lanes – Part 2 – Positive Offset Design
  This was one of the best practice applications the team saw on the Wisconsin bypasses. This design application should be encouraged and expanded. The team believes that this should be used at all at-grade intersections on the bypasses. Along these lines, the team thought that WISDOT should have a standard "footprint" for intersections that would be applied whether they are signalized or unsignalized. The footprint would include positive offset left turn lanes for all intersections. In addition, the team felt that the current design of the offset could be slightly adjusted so that the two opposing left turn lanes are not directly lined up but would rather be a little more offset to the left. Figure 3 shows the view from one left turn lane to another. Further offsetting these lanes could provide some possibility to better manage traffic that is crossing the median from a minor road to turn left onto the bypass or continue straight across on the minor road.

Figure 2: Typical example of a marked left turn lane on a 2-lane roadway.

Figure 3: Example of a positive offset left turn lane.

- Pavement Markings
  The team identified several locations on the bypasses where WISDOT is using state of the art pavement markings that are highly retroreflective and show up in rain or shine. Figure 4 illustrates some very good marking applications on the Oconomowoc Bypass. However, the majority of the locations did not have pavement markings of this higher visibility and quality. This was particularly evident on the Whitewater Bypass. The team noted that the bypass roads in the state should always receive a higher quality of marking given the nature of the high speed through traffic on these bypass roadways. In particular, the team noted the lack of pavement markings in the larger median crossing areas (covered in more detail below) and particularly at the unusual intersections (e.g. Cox Rd.) which directly influence both operations and safety.

Figure 4: Two types of pavement markings used together on the Oconomowoc Bypass illustrate a very visible treatment in various situations.

- Median Treatments at Crossings
  Figure 5 shows an example of two cars conflicting as to turning paths in the large median opening at-grade intersection on the Fond du Lac Bypass.

Figure 5: Conflicting turning vehicles on the Fond du Lac Bypass.

Figure 6 provides a view of the same intersection that illustrates the size of the intersection and the large, uncontrolled area that drivers confront when entering or crossing a bypass in

Wisconsin. The conflicts witnessed at this location and others are brought about by a variety of design decisions.

Figure 6: View of wide open area at a bypass at-grade intersection.

On the Fond du Lac Bypass, conflicts arise from not having positive offset turn lanes and not providing any guidance as to turning path to the driver in the median area. On the Fort Atkinson and Oconomowoc Bypasses, conflicts can arise from placement of the positive offset lanes as well as lack of guidance in the median area. There are several ways to address these. The extent of offset of the left turn lanes is not very critical and does not require retrofit of existing intersections, but it would be good to adjust standard plans for the future.

For those bypasses intersections that do not have positive offset left turn lanes, WIDOT should consider installation of this best practice geometric intersection configuration in the future. For the Whitewater bypass intersections without left turn lanes, they should be added.

For locations with large median areas, consideration should be given to installing "Yield" signs in the median intersection area to better guide and control driver behavior at the "second" crossing/turning point in these divided highway crossings. Figure 7 provides an illustration of this "2nd crossing" right of way control configuration from Missouri. This application can serve to better manage conflicts between vehicles crossing the median with each other and with non-yielding vehicles on the bypass.

Figure 7: Second crossing right of way control at in a median in Missouri.

The team also recommends the application of pavement markings in the median area of intersections. The pavement markings are needed to divide opposing traffic and to define vehicle path as to turning location to supplement the "2nd crossing" right of way control.

- "Cross Traffic Does Not Stop" Signs
  "Cross Traffic Does Not Stop" signs (Figure 8) were noted for some two-way stop controlled at-grade intersections on the bypass roads. The team recommends that they should be uniformly applied at all two-way stop controlled, at-grade intersections on the bypass roadways.

Figure 8: Illustration of a "Cross Traffic Does Not Stop" sign in Wisconsin.

- Advance Intersection Warning/Name Signs
  Given that the majority of crashes on the bypasses are intersection-related crashes, the Bypass Review team noted that advance intersection warning signs with advance cross street names signs could prove beneficial. Advance intersection warning signs provide crucial information to approaching drivers that there is an intersection ahead with possible crossing and turning traffic. In addition, on the bypasses, it is possible that drivers are looking for cross street names and therefore make them less attentive to possible conflicting traffic at the time they are entering the intersection. Advance intersection name signs are of additional assistance to drivers by identifying the specific street name before they enter the intersection itself. Figure 9 shows one example of an advance street name sign from the Oconomowoc Bypass. Figure 10 shows two examples of combination warning and name signs from locations elsewhere in the United States. Uniform application of these advance street name signs would benefit drivers on the high speed bypass roadways in Wisconsin.

Figure 9: Advance street name sign on the Oconomowoc Bypass

Figure 10: Example of advance warning/name sign combination.

- Avoid Intersections on Curves
  Placing intersections on horizontal curves should be avoided whenever possible; intersections within curves have 25% higher number of crashes. Where they exist, caution should be taken to provide clear sight distance and adequate warning and guidance to the drivers through signs and pavement markings.

- Sight Distance.
  Pay close attention to intersection and alignment sight distance. This attention is particularly important when building a 2-lane road on a 4-lane footprint. Passing sight distance may be a major issue. The road must be designed as a 2-lane road, not a 4-lane road, for the timeframe that it will be operated as a 2-lane road. In some instances, the team learned that the 2-lane facility would be in place for 20 or more years. If this is the case, the design must provide adequate passing sight distance as a 2-lane roadway for its full performance life rather than considering it to be a "temporary" road and deserving of less attention to safety.

- Intersection Lighting
  It was noted that highway lighting of the intersections is used sparsely, if at all, at many of the intersections on the bypasses. The safety benefits of lighting, particularly at intersections, are well documented. The team believes that Wisconsin could take more advantage of the safety benefits of highway lighting for bypass roads.

Other Recommendations

Training

With regard to the issue of consistency, the review team is aware that WisDOT has developed and offers an intersection design course. The team considered this a very positive step in the right direction to obtaining the desired consistency and safety performance of intersections on the bypasses. The team recommends that this course be offered routinely and regularly to design staff throughout the DOT. Equally important to providing training to appropriate designers, the DOT should assure that the right people in Regional offices and Headquarters receive this training. Specifically, project managers, project engineers and even more senior staff should attend the training and make it a priority to see that good design practices are consistently applied

on all bypass road projects. As for the course itself, the team recognizes it is a high quality course. Like all courses, it should be maintained and kept current. The FHWA Resource Center and National Highway Institute offer a variety of intersection safety courses. Though the WisDOT course is very complete and of a high quality, they should review the FHWA courses to see if they have any different ideas that might influence WisDOT decisions on desirable approaches and countermeasures. The FHWA would be happy to share materials with the State and even present some courses if the State believes it would be useful.

In addition to intersection safety, the FHWA offers a variety of other training that could be useful to WisDOT staff. For instance, FHWA offers extensive training on RSAs that could facilitate WisDOT in working towards one of the major recommendations in this report. WisDOT might also find training on the Interactive Highway Safety Design Model could provide valuable insight on including safety in the design process for 2-lane highways in direct relation to the recommendations in the report. Finally, the FHWA would be very happy to schedule one or more executive briefings (1 to 2 hours) on topics in this report for the senior management of WisDOT. Presentations like these can serve to give management a better understanding of the safety effects of certain decisions thereby facilitate better policy guidance and direction department-wide.

Speed Management

Inherent with bypasses are an increase in speed design. Bypass speed limits often are higher that on surrounding roads. Drivers can easily misjudge the speed differential interfacing with bypasses. The design lends to a greater comfort factor for drivers and often a increase in speed, aggravating the speed differential for cross traffic. Drivers attempting to cross these bypasses often are ill prepared to judge the speed of approaching vehicles and the increased exposure of the wider roadways. Speed enforcement is often a challenge for these bypasses. There are limited areas to sit for stationary enforcement and moving enforcement requires turning around on these high speed roads.

In particular, the team noted that there appeared to be incidents of excessive speed on the Whitewater Bypass, the only bypass that had such information available for us. In addition, the team noted that most of the crashes on all of the bypasses are intersection-related. One safety countermeasure that has a proven track record to eliminate serious crashes is automated enforcement for both speed and red light running. In this regard, the team agrees with the views expressed in a March 7, 2006 news release from the Governors Highway Safety Association and the American Association of State Highway and Transportation Officials (Appendix D) but understands that Wisconsin has a statuatory restriction to utilizing automated speed enforcement. This ought to be reviewed and considered against the known highway safety benefits that can be realized with these technologies, particularly in situations such as exist on some of the bypass roads.

Conclusion

The Bypass Review team did find several good design practices on the bypass roadways in Wisconsin. On the other hand, it is the recommendation of the team that consistent and uniform application of good design and traffic control applications on all bypass roads in Wisconsin could make the roadways even safer. This and the other recommendations stem from the view that the Wisconsin bypasses are and should be viewed as unique roads requiring unique attention to their design criteria for safety. One very good way to ensure that safety is well balanced on these unique roads against cost and other criteria is to establish a process for routinely using road safety audits. Ultimately, the team believes that Wisconsin can effectively develop bypass roads that serve important mobility and safety needs.

APPENDIX A
Site Specific Observations

As mentioned earlier, the Team stopped and reviewed numerous sites in detail prior to arriving at the above conclusions. This section documents some of the specific sites and the findings of the team. This section is not all inclusive of the intersections on each and every bypass. Rather, it provides some details on some sites. The information from these specific sites then serves to bolster the global recommendations and to support the recommended best practices across the bypasses.

Whitewater Bypass

1. Overall Comments

   In reviewing the Whitewater Bypass there were a few things that stood out as far as the entire roadway length is concerned. Of primary concern was the lack of a consistent design approach along the bypass. This lack of consistency was especially apparent at the intersections. As a result, a general observation for Bypass improvement would be to have a single "footprint" or layout for any intersection on the Bypass route and apply this uniform design to all intersections, whether signalized or unsignalized. Similarly, the consistent application of practices from other Bypasses should be considered on the Whitewater Bypass. For example, oversized speed limit signs applied throughout the route would be valuable and could aid in more intensive law enforcement for speeding which appears to be a significant problem at Whitewater. Additionally, the consistent use of advance intersection warning signs with advance intersection name signs could add considerably to intersection approach awareness and improved driver behavior along the route. Finally, the Team noted the extensive use of right hand turn lane/bypass lanes at 4-way intersections. These should be eliminated in favor of left turn lanes that should be consistent at each intersection. In this regard, the positive offset left turn lanes are a very good application and should be encouraged for all signalized and unsignalized intersections.

   Aside from consistency issues, the team was concerned about geometric design features that were applied on the Whitewater Bypass. Specifically, the Whitewater Bypass is a 2-lane roadway that will be in existence for 20 or more years. However, it is designed as a 4-lane divided highway. This raises two issues of note. First, on a human factors level, it is very likely that drivers could be "lulled" into feeling as if they are on a 4-lane divided highway rather than a 2-lane road. This can have the result of luring drivers into making poor passing choices. Similarly, as designed, the passing sight distances are for a 4-lane highway not a 2-lane road. This too can have a negative impact on driver decision making. In the future, for bypasses designed as 2-lane roads for future conversion to 4-lane divided highways, specific consideration should be given to ensuring 2-lane design criteria are considered and applied for the "temporary" road.

   Additionally, the lack of uniformity in the geometric intersection designs can be expected to cause difficulties for drivers in terms of expectancy. "ByPass lane" geometry, "center left turn lane" geometry and "positive offset" geometry were all used within the same bypass roadway.

2. Cox Road Intersection Observations

   As the Cox Road intersection was the scene of the most recent fatality that generated considerable attention on Bypass Road design, the team dedicated some meaningful time to its review. Figures 1 and 2 provide images of the Cox Road intersection that support the team's recommendations.

Figure A1: A view of Cox Road intersection facing east on the Whitewater Bypass.

Figure A2: A closer view of Cox Road intersection facing east on the Whitewater Bypass.

The team noted several things about the intersection that can be seen in these photos. First, the intersection is located on the outside of a curve. There is a low volume of traffic on Cox Road. With the gap in centerline of the bypass highway at the Cox Road intersection, there is a lost of definition as to vehicle path and a lack of positive guidance on the Bypass roadway

at the intersection because of the horizontal curve and a slight vertical curve. There is another, better intersection on the bypass in close proximity to the Cox Road intersection.

All of these characteristics lend support to closing this intersection. This is felt to be the best alternative and is recommended by the team. However, recognizing that there may be issues or underlying criteria that the team is unaware of, there are some remedies that could improve the safety of the intersection in the hope of preventing or significantly reducing the risk of future severe crashes. In order to provide positive guidance through this intersection, a 4 foot wide median could be marked on the approaches to the intersection to divide the opposing traffic flows from the roadway width; this will provide positive separation of the opposing traffic through the intersection. Advance intersection warning signs on Highway 12 are needed for Cox Road.

3. CTH "P" Intersection Observations
   - Left hand stop sign "stop beacons" (battery pack) not working.
   - Add Overhead Stop Beacon on 12 (better option than stop beacons mounted on signs).
   - Increase the size of STOP signs to 36" STOPS on US 12 and on CTH P until signals installed.
   - Install pork chop islands for STOP signs facing side road to improve visibility
   - Left side STOP sign blocked by CTH "P" sign until almost to intersection. Reorient signs to improve visibility.
   - Add center left turn lane (positive offset) to match US 12 at S
   - Add lighting on the approaches as well as at intersection
   - Increase size of Speed Limit Signs above 24x30" to 30x36" or 36x42" and intermediate post between intersections (applies to all bypasses)
   - Revise application of R6-1 ONE WAY signs to conform to 2003 MUTCD Section 2B.37 and optional placement as shown in Figures 2B-13, 2B-14, and 2B-15 in a consistent application for each unsignalized intersection along a bypass route.
   - Add Street Name plaque with Advance Intersection Warning sign (apply consistently to all bypass intersections)

4. STH 89 Intersection Observations
   - NB approach "hooks" 250 short of intersection; need to add supplemental near right signal visible 500 feet back
   - Add STOP sign in right turn bypass lane NB direction
   - Add lighting at intersection
   - Add light to the approaches

5. CTH "S" Intersection Observations
   - Add another near right signal farther right.
   - STOP sign in right turn bypass lane NB direction
   - Light the approaches in addition to Intersection

6. Tri County Intersection
   - Add Center Positive Offset Left turn lanes on 12
   - Add Pork chop islands for placement STOP signs on Tri-County
   - Add Cross Traffic Does Not Stop for 2-Way Stop controlled bypass intersections (all bypass unsignalized Intersections)
   - Add lighting

- Increase size of Speed Limit signs and intermediate postings

Fort Atkinson Bypass

1. Overall Comments
   The team noted that crash records indicate that about 50 percent or more of the crashes occur at night. This lends itself to a recommendation for lighting to be added to exit and entrance ramps as well as all unsignalized intersections. Cross Traffic Does Not Stop signs should be installed at all 2-way stop intersections as routine. Adding pork chop islands for placement of stop signs to increase visibility of stops would benefit every intersection on this route. Adding near left hand stop signs could increase driver observance at the intersections. Using W2-1 Advance Intersection warning signs on main line (only some approaches are signed) could make drivers more aware of at-grade intersections as they approach.

2. Business 26
   Use ground mounted signal head on head of T directly in line with the approach.
   - Add Lighting

3. Banker Road
   - Double up STOP signs
   - Add Lighting
   - Add center positive offset Left turn lanes
   - Gravel everywhere in intersection. Traction problem. Clear gravel.
   - Add Pork chop islands for side road stops
   - Improve poor stop line
   - Remediate marginal sight distance on NB approach to the left

4. Hoard Road
   - Add lighting
   - Add center positive offset Left turn lanes
   - Gravel everywhere in the intersection. Traction problem. Clear gravel.
   - Add Pork chop islands for side road approaches to improve visibility of intersections
   - Improve poor stop line
   - Utilize cross traffic does not stop signs

5. USH 12
   - Utilize Cross Traffic Does Not Stop signs
   - Apply traffic pylons (also known as super ducks or breakaway delineators) at ramp entrances.

6. Business 26 end
   - Add Cross Traffic Does Not Stop signs
   - Apply traffic pylons at ramp entrances
   - Add lighting

7. Whitetail Rd

Add lighting
   - Use pork chop islands

Oconomowoc Bypass

1. Overall Comments
   Overall the team found good practices along the Oconomowoc Bypass. Global recommendations still apply though. Given a recent fatality at the Lisbon intersection, the team did spend some time at the intersection. Observations are listed below.

2. Lisbon Observations
   - Add Lighting
   - Add Pork chop islands for visibility of stop signs
   - Add Cross Traffic Does Not Stop plaques to the STOP signs facing Lisbon Road
   - Add ONE-WAY R6-1 signs per 2003 MUTCD
   - Add Cross Road Advance Warning Signs on Main Line
   - Add secondary YIELD control for far side of crossing movement; shadow with extension of Positive Offset Marked Island extensions.

Fond du Lac Bypass

The Fond du Lac Bypass had the highest degree of consistency along its route in comparison to the other bypasses. However, given the crash situation along this route, the team identified a number of best practices in the first section of this report that could improve safety on this bypass. For instance, some form of median treatments at intersections to better manage turning and crossing traffic could improve safety. Advance intersection warning and name signs would also be valuable. Making the left turn lanes on the main line positive offset lanes could also prove valuable. Lighting at the intersections would also likely lead to a safety gain. Pork chop islands could be beneficial for the reasons stated earlier for other bypasses. The presence of the shared use path does make some applications challenging at some of the intersections.

APPENDIX B
Comprehensive List of Good Practices for Bypass Roads and Expressways

The following design and operational practices are recommendations applicable to all bypass and expressway highways unless otherwise specified and reflect the overall design and operational decisions for the bypass. The number and location of at-grade intersections on the bypass needs careful consideration, and where several of the design and operational best practices cannot be achieved, and or are not practicable, consideration should be given to an overpass or alternate routing to the bypass. In some unique situations, an interchange may be appropriate even for County Highway or Local Road crossings of the bypass. Environmental considerations may also have an impact on the overall design character of the bypass. These issues and the decisions resulting from them need to be made early in the planning and design stages for the bypass.

Geometric Design – Intersections

1. Left turn lanes with positive offset on the bypass at all at-grade intersections to enhance left turn safety
2. Pork chop islands on all crossroad approaches to the bypass to;
    a. Allows for more effective placement of supplemental STOP signs or traffic signals, and;
    b. Encourage better positioning of stopped vehicles for enhanced visibility of approaching mainline traffic.
3. Right turn lanes or tapers on a case by case basis.
4. Crossroad skew angle limited to 10 degrees or less.
5. Pork chop islands or extended islands in the median on divided bypasses with medians 30 feet or greater for placement of YIELD or STOP signs as appropriate. See Figure 1. See NCHRP 375 on median design.

Geometric Design – Roadway

1. 4-lane future bypasses designed to open initially as a 2-lane bypass shall be designed considering passing sight distance criteria for a 2-lane highway.
2. Avoid placement of intersections on horizontal or vertical curves where practicable.
3. Strive for the maximum sight distance practicable at intersections, particularly where horizontal and or vertical curves cannot be avoided at an intersection.
4. In some cases, roundabouts my be the safest and best operational choice for an intersection and should always be considered.

Signing

All signs used on a bypass and the approaches thereto should be Expressway size to emphasize the unique nature of a bypass highway.

1. Advance crossroad name signs (black letters on a yellow background) on the bypass at all at-grade intersections consistently used with one of the following as appropriate. Double up all assemblies, right and left side, on divided bypass highways.
    a. An intersection warning sign, or
    b. A Stop Ahead sign, or
    c. A Signal Ahead sign
2. Advisory Speed plaques may be appropriate on the bypass at some intersections based primarily on traffic volume, including turning movement percentages. These plaques would be mounted with the advance crossroad sign assemblies as noted in item 1 above

3. Supplemental STOP sign in the pork chop islands on the crossroads.
4. 2-Way plaques and CROSS TRAFFIC DOES NOT STOP signs mounted below the crossroad STOP signs at 2-way stop controlled intersections on 2 lane bypasses.
5. Divided Highway regulatory signs and CROSS TRAFFIC DOES NOT STOP signs mounted below the crossroad STOP signs on divided bypasses.
6. On divided by passes, WRONG WAY, DO NOT ENTER and One Way signing consistent with Figures 2B-10 to Figure 2B-15 at all intersections.
7. STOP or YIELD signs as appropriate at the second crossroad intersection of divided bypasses.
8. On 2-lane bypasses with overpasses built to 4 lane capacity, or with interchanges, install Two-Way Traffic Symbol signs at strategic locations in advance of and following these elements to remind traffic that the bypass is 2-lanes even though by design, it may inadvertently appear to be divided in some sections.
9. Use temporary warning red flags on important warning or regulatory signs when the roadway is newly opened or on newly placed signs to enhance the conspicuity of critical warning or regulatory signs. Temporary warning flags "call attention" to drivers for new and/or warning and regulatory signs which enhances the effectiveness of these signs.

Markings

1. Stop bars at all crossroad intersections with the bypass aligned with the STOP sign in the pork chop island for through and left turning traffic.
2. On divided bypasses, YIELD or STOP bars as appropriate at the 2nd crossing on medians 30 feet or wider, aligned with the YIELD or STOP sign.
3. Double yellow centerline in the median on divided bypasses where STOP or YIELD signs are installed at the 2nd crossing of the bypass.
4. Use 6" width for all lane and edge lines.
5. Consider contrast markings for lane lines on divided bypasses.

Lighting

1. Lighting at all intersections including the left turn lanes consistent with the practices of the AASHTO Lighting Guide or the Illuminating Engineers Society lighting guide.
2. Light poles provide daytime recognition of the presence of intersections.

Regulations

1. Speed limits on bypasses are normally set at the maximum statutory limit for the design character of the bypass.
2. Lower overall speed limits on the bypass, and or advisory speeds at intersections may be established where numerous best practices cannot be satisfied. The importance of the best practices, such as offset left turn lanes being very important, should be a critical element of such decisions.
3. Lower maximum speed limits should only be implemented where agreements are in place with law enforcement for rigorous enforcement of the lower limits.

Traffic Signals

1. Traffic signals should be considered at intersections where ADT volumes at the intersection are 10,000 or greater.

Traffic signals should also be considered where traffic volumes are less than 10,000 and other best practices cannot be met, such as the use of offset left turn lanes, intersection sight distance is limited, or intersections will be on horizontal and or vertical curves.

APPENDIX C
Road Safety Audits

A Road Safety Audit (RSA) is a process to proactively reduce deaths and injuries on our nation's roadways. An RSA employs a proactive multi-disciplinary approach considering all road users in order to make the roads safer. The return on investment is immeasurable.

The RSA process can contribute greatly to our nation's goal to reduce fatalities and crashes. The RSA process:

- Helps produce designs that reduce the number and severity of crashes.
- Promotes awareness of safe design practices.
- May reduce costs by identifying safety issues and correcting them before projects are built.
- Considers human factors and all users.
- Integrates multimodal safety concerns.

An RSA is a review performed ideally during the design phase of a project to ensure that important safety considerations are not overlooked. RSAs can be performed earlier (e.g. during planning) or later (e.g. pre-opening) in the process. Typically a multi-disciplinary group of 3 or more people will review plans and make site visits as they consider how safety has been incorporated into the project. They will then write a report to document their findings and recommendations. It is always good practice for the people with responsibility for design to provide a written response to the findings of the RSA team to document the decision making process.

Although some concerns have been raised that the use of road safety audits would increase an agency's liability, in fact, just the opposite is true. Implementing a plan to reduce the crash potential and improve the safety performance of a roadway is actually a proactive approach to safety and should be used in defense of tort liability. This is particularly true of an RSA performed in the early stages of a project. Identifying and documenting safety issues on an existing roadway is not an admission of guilt. Rather, it is the first step in a process designed to improve safety. Proper documentation, communication and logical prioritization of an agency's plan to address safety issues would be difficult to fault.

RSAs have been used successfully worldwide for a number of years. In only the last couple of years, agencies in the United States have begun to focus on RSAs. Worldwide, the RSA concept has proven to be highly effective in identifying and reducing the crash potential of roadway projects. Globally it is estimated that one million fatalities result from motor vehicle crashes each year. The potential savings—in lives, serious injuries, and property damage—is incalculable.

Road safety audits, adaptable to local needs and conditions, are a powerful tool for state and local agencies to enhance the state of safety practices in the United States. The value of the RSA process in identifying roadway safety issues makes it an important component of any agency's safety strategy. This is an ideal value added component that states can implement within their Strategic Highway Safety Plan.

This practical approach to improving road safety can be implemented in spite of limited resources and the ongoing need to focus on maintenance and operations. The RSA process can meet the needs for collecting more pertinent, reliable, detailed and comprehensive data.

APPENDIX D
GHSA/AASHTO News Release

News Release

For Immediate Release: Contact: Jonathan Adkins
March 7, 2006 (202)789-0942, jadkins@ghsa.org

Chief State Transportation Official Meets with GHSA Leadership

Commitment to Safety, Speeding Among Issues Discussed

Washington, DC--Harold Linnenkohl, President of the American Association of State Highway and Transportation Officials (AASHTO), met with the Executive Board of the Governors Highway Safety Association (GHSA) during a session on Monday. AASHTO represents the state departments of transportation while GHSA represents the state highway safety agencies.

President Linnenkohl stressed his organization's commitment to working with GHSA members to implement the new highway authorization and to continue AASHTO's focus on safety. He said, "In my opinion, safety is the number one transportation issue. I find the number of deaths on our roadways to simply be unacceptable." Chris Murphy, Vice Chair of GHSA, commended AASHTO's leadership in safety by saying, "AASHTO is a key partner in our efforts to reduce traffic fatalities and injuries. We are delighted to be working so closely with them, particularly as states develop strategic highway safety plans."

The issue of how to reduce speeding-related fatalities received much attention during the discussion. Speeding-related deaths account for approximately a third of all traffic fatalities. Tony Kane, AASHTO's Director of Engineering and Technical Services, stated, "Automated enforcement could be the silver bullet solution in dealing with speeding and red-right running. This is based on the success of cameras in Europe and Australia." Murphy of GHSA added, "Addressing those crashes must be a national traffic safety priority on par with occupant protection and impaired driving. Speeding related crashes are not just state and local problems but rather deserve attention by all levels of government. We look forward to future GHSA-AASHTO efforts to address this pervasive problem."

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APPENDIX E

Expedited Independent safety analysis-USH 12 whitewater bypass

Thursday, September 22, 2005

Field Review: 9:30am to 12:30pm 2nd DRAFT MINUTES

Meeting: 2:00pm to 4:00pm

Field Review: USH 12 Whitewater bypass

Meeting: HF room 635 (MADISON ROOM)

Participants

Name		INIT	Organization	Field Review	Meeting
Pat	Hawley	PH	R.A. Smith	Y	Y
William	Bremer	WB	USDOT – FHWA	Y	Y
Dave	Platz	DP	USDOT – FHWA	Y	Y
Richard	Lange	RL	WisDOT BHO	Y	Y
John	Bridwell	JB	WisDOT BPD	Y	Y
Patrick	Fleming	PF	WisDOT BPD		Y
Ronald	Nohr	RN	WisDOT BPD		Y
Beth	Blum	BB	WisDOT SE Region	Y	Y
Christopher	Quesnell	CQ	WisDOT SE Region	Y	Y

Notes

The USH 12 Whitewater bypass was opened to traffic on August 4, 2005. The bypass is south of Whitewater and is about 6.3 miles long. The bypass is an interim 2-lane roadway of an ultimate 4-lane construction. With current traffic projections, it is not anticipated that 4-lanes will be needed for another 20+ years.

The corridor is access controlled. There are presently 4 at-grade intersections:

1. Tri-County Road
2. CTH S
3. STH 89
4. CTH P

All of these intersections will be converted to interchanges when the road is ultimately built to 4-lanes. The CTH S intersection is currently signalized and was built with left turn lanes on USH 12. It also has streetlights. The other intersections are currently 2-way stop control (i.e. the stop sign is only on the crossroad) and do not have left turn lanes on USH 12. They also do not have streetlights.

The average speeding ticket has been for 71 mph. The 85th percentile is 60 mph

There have been two fatal crashes on the bypass since its opening – one at the STH 89 intersection, and the other at the CTH P intersection. There have also been 3 other injury crashes and 1 other property damage crash at the STH 89 intersection.

In response to these crashes, the WisDOT SE Region has begun installation of signals at STH 89 along with construction of left turn lanes on USH 12. The intersection at CTH P will be re-constructed in the spring of 2006 with signals and left turn lanes on USH 12. All-way stop sign

control is being installed this week as a temporary measure. Two STOP signs will be installed on each leg of the intersection. Flashers will be added on near right STOP signs, and flags will be added to all STOP signs and to advance signing. In addition, message boards will be placed on USH 12 to alert drivers. The stop signs will remain in place until the spring of 2006. In addition, streetlights will be added at both intersections, as well as at Tri-County Road.

In addition to the above actions, WisDOT's Central Office and SE Region office decided that an independent field review of these intersections should also be conducted by a team made up of members from WisDOT's Bureau of Project Development (BPD) and Bureau of Highway Operations (BHO), FHWA, and a consulting traffic engineer. The purpose of this independent review was to offer additional possible countermeasures, and to offer suggestions for future considerations when bypasses are opened. Following are the observations and suggestions from that field review.

NOTE: USH 12 is considered the East-West roadway at all of the intersections

1. USH 12 – CTH P Intersection

Observations and Suggestions

- We couldn't see the true speed conditions at the intersection because an incapacitated sod truck was impeding traffic. His load had shifted and partially dumped onto the shoulder near the intersection. There was speculation that the truck had turned left onto USH 12 EB from CTH P SB, and that the superelevation may have been at least partially responsible for the load shift.
- Having CTH 'P' intersect on a curved superelevated section of USH 12 isn't desirable
- 4-way STOP will help.
- [i]STOP BAR locations are difficult for motorists to see due to the grade change on the approach (see Picture 13) – no 2 vehicles stopped in same place. Nobody stopped at STOP BAR; correct stopping place can't be seen. Drivers appeared hesitant to pull up to the STOP BAR, which is nearer to the USH 12 driving lanes than the STOP sign.

Picture 13 – on CTH P ~ 200' north of US 12 (kneeling to approximate driver eye height) looking South on CTH P towards USH 12

- There are no STOP AHEAD signs on southbound CTH P north of USH 12 because construction is not finished. Temporary signs should be installed until the permanent signs can be placed.
- [ii]The 2006 intersection re-design should resemble CTH 'S'
- [iii]4-way stop may result in icing at intersection. Get County to maintain to guard against this.
- [iv]Placing STOP BARS farther back can help vision on inside of curve. (CTH P south of USH 12).
- [v]The flash-rate on changeable message boards is too fast. The message display rate should be a minimum of 3 seconds.
- The crest vertical curve on USH 12 700-ft west of CTH P will not be an issue with all way control
- CTH P is a Type A WisDOT typical rural intersection.
- [vi]Trucks had trouble staying in their lane when turning at CTH P
- [vii]Flashing board will take place of rumble strips in alerting drivers to STOP signs on USH 12 at CTH P
- [viii]Use large STOP sign (48" on US 12 – 36" on CTH P)
- [ix]Consider airport flashers – blinker stops
- Mast arms for STOP signs are used to make signs more easily visible. They are not necessary here because signs are temporary, and because message boards are being used.
- [x]Group agreed that message boards should be up all winter, instead of for 30 days.
- [xi]Signals are not a good long-term solution for safety. Roundabout should be considered. A roundabout might be designed with a bypass lane from USH 12 WB to CTH P NB.
- Concerned about putting signals on high speed bypass

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2. USH 12 – STH 89 intersection

Observations and Suggestions

- All-way intersection control is appropriate, i.e.4-way STOP signs, signals, or roundabout. Signals are consistent with the intersection control at CTH S.
- [xii]Some visibility at stop locations is lost due to traffic signs partially obstructing driver's line of sight from STH 89, e.g. Guide sign looking to east, j-assembly looking west, signs in pork-chop island.

Picture 16 - at STH 89 north of US 12 @ ~8' behind stop bar left turn lane (kneeling to approximate driver eye height) – looking West on USH 12

Picture 17 – at STH 89 north of US 12 @ ~8' behind stop bar right turn lane (kneeling to approximate driver eye height) looking East on USH 12

- [xiii]Southbound right turners have vision partially blocked by junction signs
- [xiv]STH 89 is located in a sag vertical curve on USH 12. Vehicles in USH 12 WB right turn lane can obscure vehicles in USH 12 WB thru lanes from drivers stopped on STH 89. One of the fatal and one injury crash appeared to be related to this issue.
- The location of stop bars on STH 89 do not appear to be an issue
- [xv]USH 12 right turn lanes should be offset because right turns from STH 89 will be stop sign controlled.
- The Line of Sight for a driver stopped on STH 89 south of USH 12, and looking to the east to see on-coming USH 12 westbound traffic, crosses outside of the USH 12 shoulder.

Picture 18 – on STH 89 South of US 12 @ ~8' behind stop bar (kneeling to approximate driver eye height) looking East on USH 12

- [xvi]Concerned that signal timing not cause USH 12 to queue up beyond the limits of the left turn lane. Traffic volumes on USH 12 are low enough that this is not likely to be a problem, but should be monitored.
- An interchange is the ultimate design planned for the USH 12 – STH 89 intersection. It might be necessary to consider building the interchange sooner than currently planned if there continue to be safety or traffic volume problems. USH 12 should be built as a 4-lane divided roadway through the interchange area when the interchange is built.

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3. USH 12 – CTH S intersection

Observations and Suggestions

- No suggestions for enhancements
- Semi-actuated signals seem to be working well
- Positive offset of left turn lanes is good

Picture 27 – on US12 EB left turn lane looking east on USH 12 at CTH S intersection

- Observed mid-day traffic was lower than at CTH 'P' (obviously, a very limited observation)
- Well-designed signalized intersection

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4. USH 12 – Tri-County Road intersection

Observations and Suggestions

- [xvii]Remove trees west of intersection and south of US 12 – will improve sight distance for northbound Tri-county (see note above that USH 12 is considered EW road)

Picture 34 – on Tri County Road South of US 12 @ ~8' behind stop bar looking West on USH 12

- [xviii]Mowing needed – tall grass on SW quadrant of intersection
- [xix]The CURVE sign and the 45 MPH SPEED LIMIT sign on north leg of Tri-county are too close together.
- [xx]Check southbound stop bar on Tri-county to see if it should be moved up
- Right-turn lane operates as bypass lane

- [xxi]Left-turn lanes on USH 12 are desirable. This will make USH 12 wider, but this shouldn't be detrimental to the higher volume movements at the intersection. Evaluate need for left turn lanes based on traffic counts and based on functional need.
- We observed very low traffic at Tri-County Road
- [xxii]We did see lane deviation violations outside of traffic pavement marking by turning vehicles.

5. USH 12 – General Comments

Observations and Suggestions

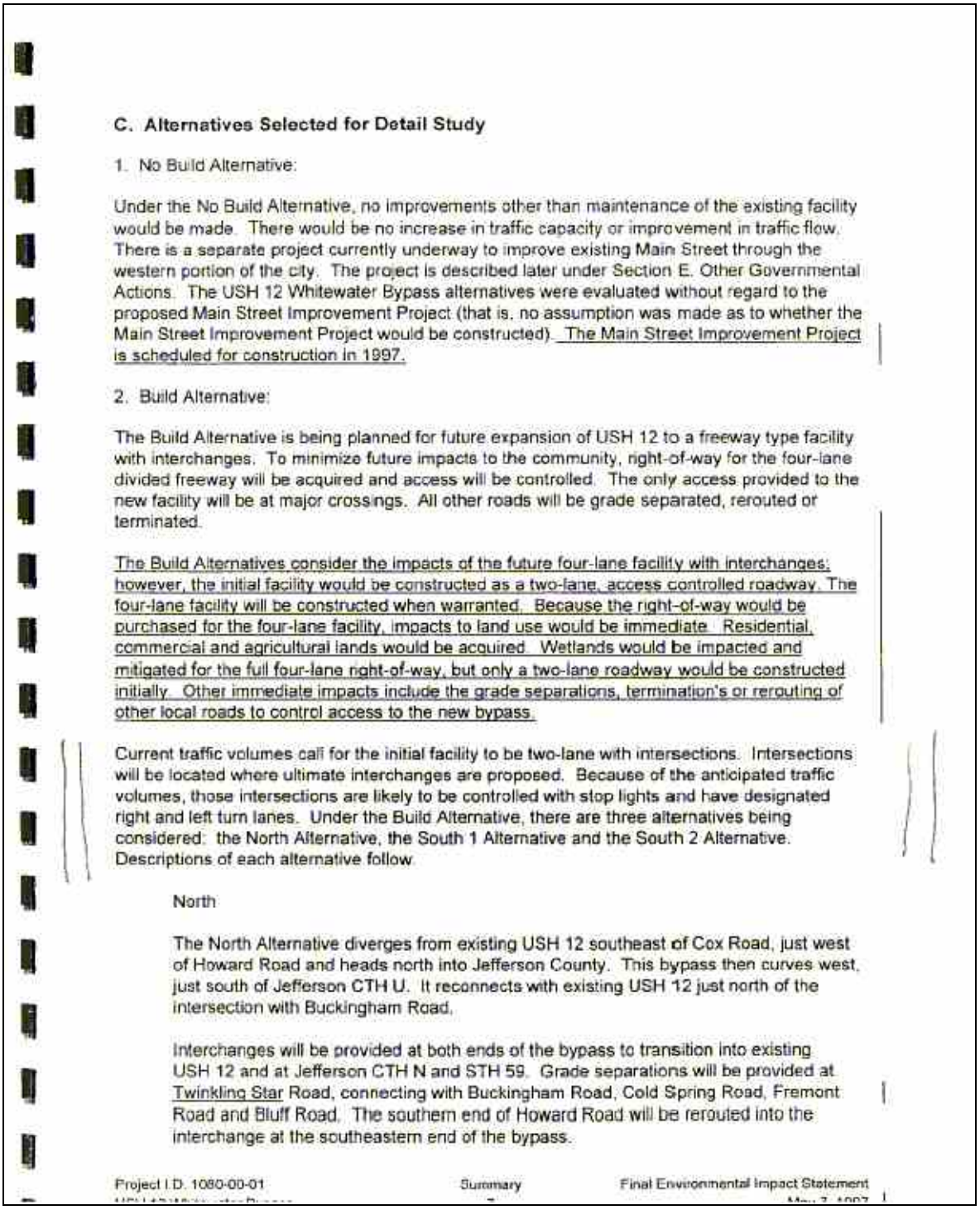
- The design of a 4-lane divided highway has some different design considerations than a 2-lane roadway (passing sight distance isn't considered, etc.). Building a 2-lane interim roadway on a 4-lane ultimate corridor requires reconsideration of some design elements, i.e. sight distances, to ensure the safety of the interim design.
- Continue to use speed board for driver awareness of speed violations.
- [xxiii]Traffic counts will assist in monitoring the traffic operations.
- [xxiv]Add Signing: "Headlights on for safety"
- Continue speed enforcement
- [xxv]Lowest volume roads are all grade separated while the higher volume roads are at-grade.
- [xxvi]How do current traffic counts differ from projected traffic counts for project?
- [xxvii]Consistency of approach at all intersections is desirable.
- [xxviii]Conduct non-work zone related speed studies throughout the corridor.

6. Strategies for the opening of new facilities like this to acclimate drivers to the new roadway

Suggestions

- Information campaign
- Extra enforcement
- Flags, message boards
- Public announcements
- Special enforcement until traffic gets acclimated (speeders – average 71 mph)
- The 1997 EIS (see Figure 1) anticipated that, due to traffic volumes, the interim intersections "are likely to be controlled with stop lights and have designated right and left turn lanes." Since the bypass is on new alignment, only traffic projections were available, not actual counts. Future 2-lane interim bypasses should have either signals with left and right turn lanes or roundabouts installed prior to opening the bypass.

Figure 1 – Page 7 of Summary from FEIS for ID 1080-00-01, USH 12 Whitewater Bypass, dated May 7, 1997



C. Alternatives Selected for Detail Study

1. No Build Alternative:

Under the No Build Alternative, no improvements other than maintenance of the existing facility would be made. There would be no increase in traffic capacity or improvement in traffic flow. There is a separate project currently underway to improve existing Main Street through the western portion of the city. The project is described later under Section E. Other Governmental Actions. The USH 12 Whitewater Bypass alternatives were evaluated without regard to the proposed Main Street Improvement Project (that is, no assumption was made as to whether the Main Street Improvement Project would be constructed). The Main Street Improvement Project is scheduled for construction in 1997.

2. Build Alternative:

The Build Alternative is being planned for future expansion of USH 12 to a freeway type facility with interchanges. To minimize future impacts to the community, right-of-way for the four-lane divided freeway will be acquired and access will be controlled. The only access provided to the new facility will be at major crossings. All other roads will be grade separated, rerouted or terminated.

The Build Alternatives consider the impacts of the future four-lane facility with interchanges; however, the initial facility would be constructed as a two-lane, access controlled roadway. The four-lane facility will be constructed when warranted. Because the right-of-way would be purchased for the four-lane facility, impacts to land use would be immediate. Residential, commercial and agricultural lands would be acquired. Wetlands would be impacted and mitigated for the full four-lane right-of-way, but only a two-lane roadway would be constructed initially. Other immediate impacts include the grade separations, termination's or rerouting of other local roads to control access to the new bypass.

Current traffic volumes call for the initial facility to be two-lane with intersections. Intersections will be located where ultimate interchanges are proposed. Because of the anticipated traffic volumes, those intersections are likely to be controlled with stop lights and have designated right and left turn lanes. Under the Build Alternative, there are three alternatives being considered: the North Alternative, the South 1 Alternative and the South 2 Alternative. Descriptions of each alternative follow.

North

The North Alternative diverges from existing USH 12 southeast of Cox Road, just west of Howard Road and heads north into Jefferson County. This bypass then curves west, just south of Jefferson CTH U. It reconnects with existing USH 12 just north of the intersection with Buckingham Road.

Interchanges will be provided at both ends of the bypass to transition into existing USH 12 and at Jefferson CTH N and STH 59. Grade separations will be provided at Twinkling Star Road, connecting with Buckingham Road, Cold Spring Road, Fremont Road and Bluff Road. The southern end of Howard Road will be rerouted into the interchange at the southeastern end of the bypass.

Project I.D. 1080-00-01 Summary Final Environmental Impact Statement

SE region responses:

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[i] [SE Region response] Field observations show that drivers are stopping in different locations. They were not stopping at the existing stop bar. Therefore, we would not expect moving the stop bar to change these driver habits. In addition, with the new all-way stop control, the stop bar location is not critical.

[ii] [SE Region response] This will be considered in design.

[iii] [SE Region response] This concern was forwarded to the maintenance unit.

[iv] [SE Region response] With the new all-way stop control, this modification is not needed.

[v] [SE Region response] The flash rate was slowed down, however, because of the age of the CMS they cannot change it any further. Once the signal is operating at STH 89/USH 12, they will move those newer CMS to CTH P intersection for the winter, which will allow for the slower flash rate.

[vi] [SE Region response] The truck turning templates will be reviewed as part of the signal design.

[vii] [SE Region response] The Town of Whitewater stated that they do not want rumble strips due to the noise they generate.

[viii] [SE Region response] Existing safety features include double marked 36" stop signs, red flashing beacons on the near right stop sign on all approaches, CMS signs for advance warning on USH 12 and NB CTH P, and double marked STOP AHEAD signs. In addition, all signs include flags. Since the 48" signs need to be specially ordered, and given the other additional safety features, we are not recommending the 48" stop signs.

[ix] [SE Region response] Since this is a temporary condition, we are not recommending this solution.

[x] [SE Region response] This has been committed to for the entire duration of the all-way stop condition.

[xi] [SE Region response] A roundabout will not be installed at this location for a couple reasons. First, there is an interest in maintaining uniformity on the bypass. Since CTH S was already signalized and STH 89 will be signalized, adding signals at CTH P will maintain this uniformity. Second, a high-speed roundabout has yet to be opened on a Wisconsin state highway. Given the problems already experienced on the Whitewater bypass, there is no interest in trying a new type of control. Third, due to the short design timeline and no future public information meetings, adding a roundabout is not a feasible option.

[xii] [SE Region response] Signing changes will be made for traffic signal installation.

[xiii] [SE Region response] Signing changes will be made for traffic signal installation.

[xiv] [SE Region response] Traffic signals should help this issue.

[xv] [SE Region response] A typical Type A intersection was designed for this location. With signals being installed, this situation will be improved.

[xvi] [SE Region response] This has been reviewed and will not be a problem. The queues are significantly less than the 350' left turn lanes that will be installed.

[xvii] [SE Region response] This will be reviewed. The trees will most likely be removed.

[xviii] [SE Region response] We will watch this issue next summer and make comments to maintenance if it becomes an issue.

[xix] [SE Region response] This will be moved.

[xx] [SE Region response] We will check this to improve the visibility.

[xxi] [SE Region response] After traffic counts are received we will review this change. The downside to this modification is that the intersection becomes larger, which may make it more difficult for vehicles to cross.

[xxii] [SE Region response] This is due to the lack of volume at this intersection and driver comfort in making these particular maneuvers.

[xxiii] [SE Region response] New traffic counts will be conducted after construction is completed.

[xxiv] [SE Region response] Discussions with CO-BHO will determine this. We can get this message across through other educational opportunities also.

[xxv] [SE Region response] This was a planning level decision to control access and maintain the corridor for 4-lane freeway, while also providing interim access to the major crossroads.

[xxvi] [SE Region response] We will have more information once new traffic counts are performed.

[xxvii] [SE Region response] See note above regarding roundabouts on CTH P.

[xxviii] [SE Region response] New speed studies will be conducted after construction is completed.